ROLL-UP CONVEYOR FOR A SOD HARVESTER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/395,912, filed on July 15, 2002. The disclosure of the above application is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to the art of sod harvesting, namely the cutting and rolling of sod strips from the ground for distribution and relaying at a job site.

BACKGROUND OF THE INVENTION

[0003] Sod harvesting for commercial applications typically occurs by cutting strips of sod from the ground using a tractor-driven sod harvester. The cut strips are formed into rolls and stacked for pick up and transportation in bulk.

[0004] Mechanisms to automatically roll strips of sod have existed for many years. The sod rolls are generally discharged at the rear, upper end of an inclined transport conveyor. The rolls are preferably discharged in a location convenient for a worker to pick up the rolls of sod and stack them onto a pile, usually on a pallet carried by the sod harvester.

[0005] For example, United States patent No. 3,509,944 (Brouwer et al.) discloses a prior art sod harvester which includes such an inclined conveyor, and in which the rolls of sod are formed adjacent the upper end of the conveyor.

[0006] United States Patent No. 4,832,130 (Brouwer et al.) discloses a self-propelled sod harvester. The harvester includes an inclined conveyor, and the conveyor delivers the strips of sod into a separate roll-forming enclosure. The roll-forming enclosure includes a pair of conveyors disposed generally at right angles to one another for forming the roll. The formed rolls are discharged onto a cart at the end of the harvester which can convey the formed roll to either side of the cart and clear of the harvester for its next pass.

[0007] The position of the flap, or outside end of the roll, becomes important for the worker, commonly called a "stacker", who lifts and transports the rolls of sod. Figure 1 depicts a side view of a sod roll 1 after discharge from the roll-up mechanism onto a platform 2 or conveyor (not shown). If the flap 3 is located too far clockwise, it could fall down, partially unrolling the roll of sod. If it is located too far counterclockwise, a flap may hang down as it is picked up for stacking, which may be inconvenient to the stacker. Stackers typically prefer to have the flap located consistently to make their handling of the roll more predictable. The flap location becomes more important when the roll of sod will be handled mechanically, as with the robotic sod stacker, such as in a related application entitled "Robotic Sod Stacker" and filed on the filing date of the present application.

[0008] One common method of rolling a strip of sod utilizes a roll-up conveyor 5, which is located at the rear upper end of the transport conveyor 4.

Ahead of the roll-up conveyor, the sod roll is started by catching and turning back the leading edge on a curved piece of expanded metal 6, typically referred to as a starter gate. The sod continues to roll under a tray 7 that provides sufficient friction to hold the top of the newly started roll generally stationary as the transport conveyor 4 moves the sod rearward (to the left in Figure 1). As the roll moves rearward and grows, it encounters the roll-up conveyor 5, which is located above the transport conveyor 4. Roll-up conveyor 5 operates on a parallel plane but moves in a direction opposite and at a slightly slower speed than transport conveyor 4. This allows the sod roll 1 to finish being rolled in a smaller bundle than would be required if only a tray were used.

[0009] As the sod roll 1 is completed at the end of roll-up conveyor 5, it can be ejected from between the two conveyors 4, 5 by a plate 8 positioned close to the end of the roll-up conveyor. When sod roll 1 encounters plate 8, it is displaced away from the roll-up conveyor 5, and the transport conveyor 4 ejects the sod roll 1 rearward. The position of the flap can be controlled by the adjustable position of plate 8. As plate 8 moves further forward (to the right in Figure 1), sod roll 1 will be ejected sooner, and as plate 8 moves rearward (to the left), sod roll 1 will be ejected later.

[0010] This apparatus and method of flap control has generally proven to be effective for most manual stacking conditions. However, even with the flap control plate 8 held stationary, the flap position may still change due to variations in sod thickness, length of the strip, and amount of slip between the sod and the two conveyors. Some designs have attempted to make the flap position easier to control

than designs that require relocating the plate. For example, Nannings Van Loon has developed a mechanism which can move the flap adjuster plate back and forth using an electric actuator and a toggle switch. Brouwer turf Equipment also offers a variable speed hydraulically-driven roll-up conveyor, which can easily be adjusted to control the flap position. Both of these methods, however, require manual intervention to correct the flap position. Automated stacking requires automatic flap control.

[0011] All previous methods have been based on an assumed consistent location of the leading edge of the sod strip, consistent length, and consistent thickness. This greatly controls the location of the flap by varying the amount of time the sod roll sends in the roll-up conveyor or by the speed of the roll-up conveyor.

SUMMARY OF THE INVENTION

[0012] This invention is directed to a roll-up conveyor that ejects the sod roll based on the position of the end of flap of the sod roll.

[0013] The roll-up conveyor of the present invention includes a device for sensing the end, or trailing edge, of the strip of sod and a device for holding the roll in the roll-up conveyor as it continues to roll. The roll-up conveyor also includes a device for ejecting the roll from the roll-up conveyor in a manner responsive to the position of the trailing edge of the strip of sod.

[0014] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred

embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0016] Fig. 1 depicts a sod roller in accordance with the conventional design, as is known in the art;

[0017] Fig. 2 is a sod roller arranged in accordance with the principles of the present invention; and

[0018] Fig. 3 is a control system for operating the sod roller of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The following description of the preferred embodiments is merely exemplary in nature and is in no way intended to limit the scope of the invention, its application, or uses.

[0020] Figure 2 depicts a side view of a roll-up mechanism 20 arranged in accordance with the principles of the invention. The roll-up mechanism 20 includes a transport conveyor 4, a starter gate 6, a tray 7, and a roll-up conveyor 5, which operate as described in connection with Figure 1. In accordance with the present invention, the roll-up mechanism 20 further includes a device for sensing the end of the strip of sod, specifically a runner 9 rides on sod strip 10. Once the end of sod

strip 10 has passed the runner 9, runner 9 drops down to the level of the transport conveyor. A flange 22 linked to runner 9 activates a proximity switch 11. Although a proximity switch 11 is shown herein, one skilled in the art will recognize that other devices for sensing the end of the sod strip 10 could include a mechanical micro-switch, various proximity sensors, or an optical sensor.

[0021] In the embodiment shown in Figure 2, a third, holding conveyor 12 located at the rear end of the roll-up conveyor holds the sod roll 18 in the roll-up conveyor. Holding conveyor 12 is generally vertical and rotates in the same directions as roll-up conveyor 5, but at the same surface speed of transport conveyor 4. The lower end of the holding conveyor 12 is located slightly lower than the rear end of roll-up conveyor 5. The relative positioning of the conveyors forms a slight pocket between the two conveyors, which holds sod roll 18. One skilled in the art will recognize that a roller may be substituted for the holding conveyor 12.

[0022] Figure 3 depicts a system 30 for ejecting the sod roll from 18 roll-up conveyor 5 in response to the position of the trailing edge of sod strip 10. System 30 includes a valve 13 that controls rotation of the holding conveyor 12. When holding conveyor 12 stops, transport conveyor 4 carries the sod roll 18 rearward (to the left in Figure 2) and ejects sod roll 18.

[0023] Hydraulic valve 13 is controlled electronically. When the trailing edge of sod strip 10 is sensed, controller 14 receives a signal. After a predetermined delay, controller 14 sends a signal to stop holding conveyor 12. The predetermined delay can be controlled either with a timer or with a counter. As shown, counter 15 counts pulses from a proximity sensor 16 that senses teeth of a

sprocket 17 mounted to the transport conveyor 4 drive. As a tooth of sprocket 17 passes proximity sensor 16, proximity sensor 16 sends a signal to controller 14.

[0024] Roll-up mechanism 20 ejects sod roll 18 from roll-up conveyor 5 based on the position of the end, or the flap, sod roll 18, as sensed by runner 9. The time delay from when the end of the strip is sensed can be adjusted so that the end of the flap is at a desired angular position about the roll at the moment when the roll is ejected from the roll-up conveyor.

[0025] The present invention eliminates variability in the position of the flap. The present invention is less susceptible to variation in the length of sod because the trailing edge portion, or flap, of the sod strip is what controls the timing of the ejection. Variation in sod thickness and amount of slip have limited effect on the position of the flap because the sod continues rolling for only a short time after the control signal is generated.

[0026] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.